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Clean Energy Project Analysis Software

Project information [See project database](#)


Project name: Molino Arco Fourty
Project location: Molino de Los Arcos

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Project type: Power
Technology: Hydro turbine
Grid type: Isolated-grid
Analysis type: Method 1
Heating value reference: Higher heating value (HHV)
Show settings





Site reference conditions [Select climate data location](#)

Climate data location: San Cristóbal de las Casas
Show data



	Unit	Climate data location	Project location
Latitude	'N	16.8	16.8
Longitude	'E	-92.6	-92.6
Elevation	m	828	828
Heating design temperature	°C	13.8	
Cooling design temperature	°C	29.1	
Earth temperature amplitude	°C	10.9	

Month	Air temperature	Relative humidity	Daily solar radiation - horizontal	Atmospheric pressure	Wind speed	Earth temperature	Heating degree-days	Cooling degree-days
	°C	%	kWh/m ² /d	kPa	m/s	°C	°C-d	°C-d
January	19.1	71.0%	4.67	92.4	3.1	19.9	0	281
February	20.5	65.6%	5.42	92.3	2.9	21.8	0	294
March	22.0	61.5%	6.20	92.2	2.7	23.8	0	371
April	23.4	62.6%	6.41	92.1	2.2	25.4	0	402
May	23.5	70.3%	6.05	92.0	2.0	25.1	0	419
June	23.0	78.2%	5.55	92.1	2.0	24.0	0	390
July	22.6	76.6%	5.89	92.2	2.4	23.4	0	390
August	22.8	75.0%	5.70	92.2	2.2	23.8	0	398
September	22.4	79.3%	4.99	92.1	2.0	23.2	0	371
October	21.3	79.3%	4.68	92.1	2.5	22.1	0	351
November	20.4	76.0%	4.67	92.2	2.8	21.1	0	311
December	19.3	74.3%	4.46	92.3	3.2	19.9	0	287
Annual	21.7	72.5%	5.39	92.2	2.5	22.8	0	4,264
Measured at	ft				10.0	0.0		

[Complete Energy Model sheet](#)

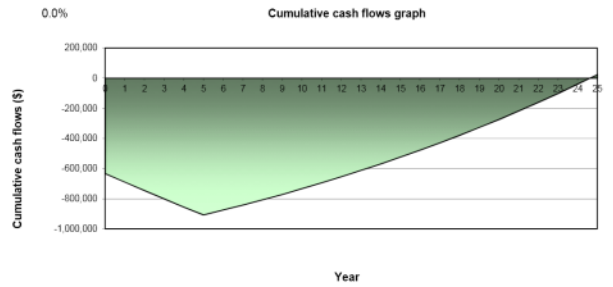
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Proposed case power system		Incremental initial costs
Technology	Hydro turbine	
Analysis type	Method 1 Method 2	
Hydro turbine		
Power capacity	kW	8
Manufacturer	Canyon Hydro	
Model	Pelton	
Capacity factor	%	90.0%
Electricity exported to grid	MWh	66
Electricity export rate	\$/MWh	419.00
		\$ 157,292 See product database

Emission Analysis

Financial Analysis

Financial parameters			
Inflation rate	%	3.6%	
Project life	yr	25	
Debt ratio	%	37%	
Debt interest rate	%	4.50%	
Debt term	yr	5	
Initial costs			
Power system	\$	157,292	15.7%
See Costs Appendix	\$	845,730	84.3%
Total initial costs	\$	1,003,022	100.0%
Incentives and grants			
	\$	0	0.0%
Annual costs and debt payments			
O&M (savings) costs	\$	1,176	
Fuel cost - proposed case	\$	0	
Debt payments - 5 yrs	\$	84,538	
	\$	0	
Total annual costs	\$	85,714	
Annual savings and income			
Fuel cost - base case	\$	0	
Electricity export income	\$	27,575	
	\$	0	
Total annual savings and income	\$	27,575	
Financial viability			
Pre-tax IRR - equity	%	0.2%	
Pre-tax IRR - assets	%	-1.9%	
Simple payback	yr	38.0	
Equity payback	yr	24.6	



RETScreen Tools - Power project

Settings		
As fired fuel	Ground heat exchanger	User-defined fuel - gas
Biogas	Heat rate	User-defined fuel - solid
Building envelope properties	Heating value & fuel rate	Water & steam
Appliances & equipment	Hydro formula costing method	Water pumping
Electricity rate - monthly	Landfill gas	Window properties
Electricity rate - time of use	Unit conversion	Custom 1
GHG equivalence	User-defined fuel	Custom 2

Hydro formula costing method

Country	Mexico		
Local vs. Canadian equipment cost ratio		0.55	
Local vs. Canadian fuel cost ratio		0.55	
Local vs. Canadian labour cost ratio		0.56	
Equipment manufacture cost coefficient		1.50	
Exchange rate	\$/CAD	12.26	
Cold climate	yes/no	Yes	
Frost days at site	day	0	
Design flow	m ³ /s	6.717447	0
Gross head	ft	30	0
Number of turbines	turbine	1	0
Type		Pelton	Kaplan
Flow per turbine	m ³ /s	0.19	
Turbine runner diameter per unit	m	0.23	
Facility type		Micro	Micro
Existing dam	yes/no	Yes	
New dam crest length	ft	8	
Maximum hydraulic losses	%	10.0%	0.0%
Miscellaneous losses	%	5.0%	
Road construction			
Canal			
Penstock			
Transmission line			
Grid type		Isolated-grid	Isolated-grid
Length	km	1.0	
Difficulty of terrain		3.0	
Voltage	kV	12.0	
	Amount	Adjustment factor	Amount
Initial costs (credits)	\$		\$
Feasibility study	0	1.00	0
Development	0	1.00	0
Engineering	51,000	1.00	51,000
Power system			
Hydro turbine	988,000	1.00	988,000
Road construction	0	1.00	0
Transmission line	461,000	1.00	461,000
Substation	6,000	1.00	6,000
Balance of system & miscellaneous			
Penstock	0	1.00	0
Canal	0	1.00	0
Tunnel	0	1.00	0
Other	0	1.00	0
Sub-total:	0		0
Total initial costs	1,506,000		1,506,000
			100.0%

[See maps](#)

Additional Initial Costs

	Pesos (MXN)
Permits for using federal water	2,745.00
Permits for constructing 10 km from federal water	1,163.00

Material	Amount	Cost (in Pesos)
Rebar	4000 1/2' poles	\$400,000.00
Cemento	151178 kg	\$347,709.82
Caja Interruptor		1 \$92.50
Cable Electrico		
12 Gague	100m	\$520.00
Transmission Line/Acometeda per km		\$1,500.00
Power Pole/Mofa		\$2,000.00
Initial Labor (2 men at 100 pesos/day each 1 Boss (250 pesos/day) for		\$90,000.00
Total Cost		\$845,730.32

Canal Construction Prices	(MXN)
Based on Price Quotes in S.C.	
Pay for Construction Boss	\$250.00
Pay for Workers	\$100.00
Cement 50 kg Bag	\$115.00
Rebar 1/2" 2 meter Poles	\$100.00

Assumptions on Cement/Concrete
 Concrete contains 15% Cement
 Cement weights 52 lb/ft³
 1 kg is 2.2 lbs

Labor Assumptions
 Two workers with one boss can build 5 m a day
 1000 meters of canal
 5 meters per day
 200 days to build

Pay	
Boss	\$50,000.00
2 Workers	\$40,000.00
Total	\$90,000.00

Canal Dimensions & Cost Assumptions

Wall Width	\$1.00 ft	0.3048 m
Wall Height	5 ft	1.524 m
Wall Length	3280 ft	999.744 m
Floor Width	3 ft	0.9144 m
Floor Depth	1 ft	0.3048 m
Wall Length	3280 ft	999.744 m

Total Concrete	42640 ft ³	1207.43 m ³
Total Cement	6396 ft ³	181.1146 m ³

Conversion to Kg of cement	151178.2 Kg
No. of 50 kg Bags of Cement	3024 Bags
Cost of Cement in (MXN)	347709.8 Pesos

Rebar Assumptions

1/2" 2 meter pole	0.5 m of canal
Canal Walls	2000 m
Poles for canal walls	4000 poles
Price per Pole	100 (MXN)
Total Rebar Price	400000 (MXN)

Hydrological Data from Rio Grijalva for Peje de Oro in Mm³

Adjustment factor based on only known flow for July

1.61E-16

	Rio Grijalva		Rio Peje de Oro
Jan	2550 Mm ³	409672.13 m ³	2508.77 GPM
Feb	2277 Mm ³	365813.11 m ³	2240.18 GPM
March	2050 Mm ³	329344.26 m ³	2016.85 GPM
April	1800 Mm ³	289180.33 m ³	1770.90 GPM
May	2050 Mm ³	329344.26 m ³	2016.85 GPM
June	2880 Mm ³	462688.52 m ³	2833.43 GPM
July	3050 Mm ³	490000.00 m ³	3000.69 GPM
August	3050 Mm ³	490000.00 m ³	3000.69 GPM
Sept	5050 Mm ³	811311.48 m ³	4968.35 GPM
Oct	5550 Mm ³	891639.34 m ³	5460.26 GPM
Nov	3550 Mm ³	570327.87 m ³	3492.60 GPM
Dec	2550 Mm ³	409672.13 m ³	2508.77 GPM

	Kilowatts Produced Each Month with 50% Take	Average
Jan	7.02 KWH	8.347497 KWH
Feb	6.26 KWH	
Mar	5.64 KWH	
Apr	4.95 KWH	
May	5.64 KWH	
Jun	7.92 KWH	
Jul	8.39 KWH	
Aug	8.39 KWH	
Sep	13.89 KWH	
Oct	15.27 KWH	
Nov	9.77 KWH	
Dec	7.02 KWH	

GHG Emissions Credits	http://www.3degreesinc.com/	Price (MXN) per Ton of CO2	\$152
Feed in Tariffs based on CFE	http://www.cfe.gob.mx/Paginas/Home.aspx		
Cross Flow Turbine	www.greenpelton.org	Price (MXN)	\$157,292.06